Claims

1. In a storage area network (SAN) of the type having one or more digital data processors and having a plurality of storage devices, the improvement comprising:

at least a first one of the digital data processors in communication access with at least a first one of the storage devices, the first digital data processor having a file system that effects access to that storage device,

the first digital data processor being associated with a lower capacity bound and an upper capacity bound for storage devices added to extend the file system,

a manager, in communication with the first digital data processor, that responds to a request on behalf of the first digital data processor for extension of the file system by assigning one or more further storage devices to the first digital data processor.

2. In the storage area network of claim 1, the further improvement wherein the manager identifies a storage device from among the plurality of further storage devices accessible to the first digital data processor having a capacity in a range between the lower capacity bound divided by (s) and the upper capacity bound divided by (s), and assigns that storage device to the first digital data processor, where (s) is one if the file system is not a striped RAID file system and, otherwise, is a number of stripes in that file system.

3. In the storage area network of claim 1, the further improvement wherein the manager identifies one or more storage devices from among the plurality of further storage devices accessible to the first digital data processor having capacities in a range between the lower capacity bound divided by (s) and the upper capacity bound divided by (s), and assigns to the first digital data processor the storage device from among those so identified having the greatest capacity, where (s) is one if the file system is not a striped RAID file system and, otherwise, is a number of stripes in that file system.

4. In the storage area network of claim 1, the further improvement wherein the manager assigns a plurality of storage devices having a combined storage capacity that equals or exceeds the lower capacity bound divided by (s) in the absence of identifying any storage device having a capacity in a range between the lower capacity bound and the upper capacity bound, where (s) is one if the file system is not a striped RAID file system and, otherwise, is a number of stripes in that file system.

5. In the storage area network of claim 4, the further improvement wherein the manager assigns storage devices with larger storage capacities before assigning those with smaller storage capacities.

6. In the storage area network of claim 1, the further improvement wherein the manager removes from selection option any storage device whose assignment to the first digital data processor, in response to a previous file extension request, had failed.

7. In the storage area network of claim 1, the further improvement wherein the manager comprises a second digital data processor and wherein the first and the second digital processors are connected to the SAN via an interconnect fabric.

8. In the storage area network of claim 7, the further improvement comprising an agent associated with the first digital data processor that transmits the file extension request from the first digital signal processor to the manager.

9. A storage area network (SAN), comprising

one or more storage units,

one or more host digital data processors coupled to the one or more storage units via an interconnect,

one or more agents, each executing on an associated host digital data processor and each in communication with a manager digital data processor,

the one or more agents each identifying attributes of any of (i) the host digital data processor with which that agent is associated, (ii) the interconnect to which that host digital data processor is coupled, and (iii) storage units to which that host digital data processor is coupled, and communicating those attributes to the host digital data processor,

the one or more agents each responding to assignment, by the manager digital data processor, of a storage unit to the associated host digital data processor(s) by preventing access by that host digital data processor to others of said storage units in the SAN,

at least a selected one or the host digital data processors having a file system that effects access to that storage device and being associated with a lower capacity bound divided by (s) and an upper capacity bound divided by (s) for storage devices added to extend the file system, where (s) is one if the file system is not a striped RAID file system and, otherwise, is a number of stripes in that file system,

the manager responds to a request from the agent associated with the selected host digital data processor for extension of the file system by assigning one or more further storage devices to the first digital data processor.

10. The SAN of claim 9, wherein at least one of the host digital processors includes a software RAID file system having no stripes and number of mirror redundancies (m), and the manager extends the RAID system, in response to a file system extension request, by assigning a number of same-sized storage devices (n) to the requesting host in accord with a relation:

$$n = m + 1.$$

11. The SAN of claim 9, wherein at least one of the host digital processors includes a software RAID file system having a number of stripes (s) and no mirror dependencies, and the manager extends the RAID system, in response to a file system extension request, by assigning a number of same-sized storage devices (n) to the requesting host in accord with a relation:

$$n = s.$$

12. The SAN of claim 9, wherein at least one of the host digital processors includes a software RAID file system having no mirror redundancies and a number of stripes (s) greater than two and the manager extends the RAID system, in response to a file system extension request, by assigning a number of same-sized storage devices (n) to the requesting host in accord with a relation:

$$n = s.$$

13. The SAN of claim 9, wherein at least one of the host digital processors includes a software RAID file system having a number of mirror redundancies (m) for each stripe (s), and the manager extends the RAID file system, in response to a request for file system extension, by assigning a number of same-sized storage devices (n) to the requesting host in accord with a relation:

$$n = s*(m+1).$$

14. The SAN of claim 9, wherein at least one of the host digital processors includes a software RAID file system having a number of stripes (s) for each mirror redundancy (m), and the manager extends the RAID file system, in response to a request for file system extension, by assigning a number of same-sized storage devices (n) to the requesting host in accord with a relation:

$$n = (m+1)*s.$$

15. A method of extending a file system associated with a first digital data processor connected to a storage area network (SAN), comprising:

identifying one or more storage devices from a group of storage devices accessible to the first digital data processor, in response to a request from the first digital data processor for file system extension, having a pre-defined storage type and having storage capacities in a range between a lower capacity bound divided by (s) and an upper capacity bound divided by (s), where (s) is one if the file system is not a striped RAID file system and, otherwise, is a number of stripes in that file system,

selecting from the identified storage devices at least one storage device having a maximum storage capacity, and

assigning the selected storage device to the requesting first digital data processor.

16. A method according to claim 15, further comprising, in the absence of identification of any storage device having a storage capacity between the lower and the upper storage capacities, selecting a plurality of storage devices from among the accessible storage devices having a pre-defined storage type such that a combined storage capacity of the selected storage devices equals or exceeds the lower capacity bound divided by (s).

17. A method according to claim 16, further comprising assigning the plurality of storage devices to the requesting first digital data processor.

18. A method according to claim 16, wherein the step of selecting a plurality of storage devices further includes selecting the storage devices in descending order by storage capacity.

19. A method according to claim 18, further comprising a step of removing from selection any storage device whose assignment to the first digital data processor previously failed.

20. A method of operating a storage area network (SAN), comprising determining a number of same-sized storage devices to be assigned to a first digital data processor to extend a software RAID file system of the first digital data processor, comprising the step of determining a number of storage devices (n) for a RAID file system having no stripes and a number of mirror redundancies (m) in accord with a relation:

$$n = m + 1 .$$

21. A method of extending a RAID file system of a first digital processor connected to a storage area network (SAN), having a number of stripes (s) and no mirror dependencies, comprising determining a number (n) of same-sized storage devices to be assigned to the first digital data processor in accord with a relation:

$$n = s.$$

22. A method of extending a RAID file system of a first digital processor connected to a storage area network (SAN), comprising determining a number of storage devices (n) for RAID file system having no mirror redundancies and a number of stripes (s) greater than two in accord with a relation:

$$n = s.$$

23. A method of extending a RAID file system of a first digital processor connected to a storage area network (SAN), comprising determining a number of storage devices (n) for a RAID file system having a number of mirror redundancies (m) for each strip (s) in accord with a relation:

$$n = s*(m +1) \quad .$$

24. A method of extending a RAID file system of a first digital processor connected to a storage area network (SAN), comprising determining a number of storage devices (n) for a RAID file system having a number of number of stripes (s) for each mirror redundancy (m) in accord with a relation:

$$n = (m+1)*s .$$

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